CHAPTER SIX

ESTUARY AND COASTAL ASSESSMENT

As defined in HAR, Chapter 11-54 (October 1992), *estuaries* refer to deep characteristically brackish coastal waters in well-defined basins with a continuous or seasonal surface connection to the ocean that allows entry of marine fauna. Most estuaries in Hawaii are within embayments that generally are not subject to rapid and efficient flushing. Accumulation of silt and organic materials may occur as a result of urban and agricultural runoff. Most of these estuaries support beneficial uses, but are impacted by pollutants from land-based sources (i.e. runoff) and may thus appear "not swimmable". However, it must be remembered that the risk of illness is proportional to the amount of *Enterococcus* bacteria from sewage, not runoff, and therefore, the estuaries may remain "swimmable" despite the exceedance of the 7 CFU/ 100 ml.

The data in the following Tables 4-2B and 4-3B are exactly as reported by the WBS report generating program.

TABLE 4-2B: SUMMARY OF FULLY SUPPORTING, THREATENED AND IMPAIRED WATERS

Type of Waterbody: Estuaries (Reported in Square Miles)

DEGREE OF USE SUPPORT	ASSESSMENT CATEGORY		TOTAL ASSESSED SIZE
	EVALUATED	MONITORED	
SIZE FULLY SUPPORTING	0.04	23.71	23.75
SIZE FULLY SUPPORTING ALL *ASSESSED* USES, BUT THREATENED[a] FOR AT LEAST ONE USE	0.00	0.42	0.42
SIZE IMPAIRED[b] FOR ONE OR MORE USES	0.90	29.69	30.59
SIZE NOT ATTAINABLE FOR ANY USE AND NOT INCLUDED IN THE LINE ITEMS ABOVE	0.00	0.00	0.00
TOTAL ASSESSED	0.94	53.82	54.76

[a] Size threatened is a distinct category of waters and is NOT a subset of the size fully supporting uses. It is added into the totals in the bottom line.
[b] Impaired means partially or not supporting a designated use.

TABLE 4-3B: INDIVIDUAL USE SUPPORT SUMMARY

Type of Waterbody: Estuaries (Reported in Square Miles)[a]

GOALS	USE	SIZE ASSESSED	SIZE FULLY SUPPORTING	SIZE SUPPORTING, BUT THREAT-ENED	SIZE PARTIALLY SUPPORTING	SIZE NOT SUPPORTING	SIZE NOT ATTAINABLE	SIZE NOT ASSESSED
	OVERALL	54.76	23.75	0.42	22.32	8.27	0.00	0.00
PROTECT & ENHANCE ECOSYSTEM	AQUATIC LIFE	0.02	0.02	0.00	0.00	0.00	0.00	0.00
PROTECT & ENHANCE PUBLIC HEALTH	FISH CONSUMPTION	0.02	0.00	0.00	0.00	0.02	0.00	0.00
	SHELLFISHING	0.02	0.00	0.00	0.00	0.02	0.00	0.00
	SWIMMING	0.02	0.00	0.00	0.00	0.02	0.00	0.00
	SECONDARY CONTACT	0.02	0.00	0.00	0.00	0.02	0.00	0.00
	DRINKING WATER	0.02	0.00	0.00	0.00	0.02	0.00	0.00
SOCIAL & ECONOMIC	NON-DEGREDATION	0.02	0.00	0.00	0.00	0.02	0.00	0.00
	AESTHETICS	0.02	0.02	0.00	0.00	0.00	0.00	0.00
	AGRICULTURE	0.02	0.02	0.00	0.00	0.00	0.00	0.00
	CULTURAL OR CEREMONIAL	0.02	0.02	0.00	0.00	0.00	0.00	0.00

* Category not applicable.
\- Category applicable, no data available.
0 Category applicable, size of waters is zero.

The individual use support summary table lists the specific designated uses and combines Clean Water Act reporting and designated use reporting. The fishable goal of the Clean Water Act is reported under the Fish Consumption, Shellfishing, and Aquatic Life Support Uses, and the swimmable goal is reported under the Swimming and Secondary Contact Uses. WBS was used to generate this table.

CAUSES/STRESSORS AND SOURCES OF NONSUPPORT OF DESIGNATED USES

For those waters which were assessed and were not fully supporting their designated uses (i.e. partially and not supporting uses), the following information is being provided to illustrate the causes and sources of use impairment statewide.

RELATIVE ASSESSMENT OF CAUSES/STRESSORS

Causes are those pollutants or other stressors that contribute to the actual or threatened impairment of designated uses in a waterbody. Stressors are factors or conditions (other than specific pollutants) that cause impairment (e.g. flow and other habitat alterations, presence of exotic species). The following table provides the total size (in square miles) of estuaries affected by each cause category. A waterbody which is affected by several different causes will have its size counted separately in each relevant cause category. If the relative contribution of the cause is listed in the waterbody-specific information as "High", the size of the waterbody with less than full support is included in the "Major Contribution" column. If the contribution is listed as "Moderate" or "Slight", the size is included in the "Moderate/Slight Contribution" column. (Note that WBS uses the terms "High", "Moderate" and "Slight" rather than "Major", "Moderate" and "Minor".)

The following table contains the full list of cause categories as stored in WBS. It is provided to increase the overall usefulness of this report and the WBS database. All of the data is reported verbatim as generated by the WBS report generating program.

TABLE 4-4B: TOTAL SIZES OF WATERS IMPAIRED BY VARIOUS CAUSE/STRESSOR CATEGORIES

Type of Waterbody: Estuaries (Reported in Square Miles)

CAUSE/STRESSOR CATEGORY	SIZE OF WATERS BY CONTRIBUTION TO IMPAIRMENT	
	MAJOR	MODERATE/MINOR
CAUSE/STRESSOR UNKNOWN	-	-
UNKNOWN TOXICITY	-	-
PESTICIDES	0.00	1.42
PRIORITY ORGANICS	-	-
NONPRIORITY ORGANICS	-	-
PCBs	-	-
DIOXINS	-	-
METALS	0.00	4.48
AMMONIA	-	-

CAUSE/STRESSOR CATEGORY	SIZE OF WATERS BY CONTRIBUTION TO IMPAIRMENT	
	MAJOR	MODERATE/MINOR
CYANIDE	-	-
SULFATES	-	-
CHLORINE	-	-
OTHER INORGANICS	-	-
NUTRIENTS	0.57	27.00
pH	-	-
SILTATION	1.38	26.87
ORGANIC ENRICHMENT/LOW DO	0.00	1.70
SALINITY/TDS/CHLORIDES	-	-
THERMAL MODIFICATIONS	0.00	0.35
FLOW ALTERATIONS	-	-
OTHER HABITAT ALTERATIONS	-	-
PATHOGEN INDICATORS	0.00	15.74
RADIATION	-	-
OIL AND GREASE	-	-
TASTE AND ODOR	-	-
SUSPENDED SOLIDS	0.00	18.09
NOXIOUS AQUATIC PLANTS (MACROPHYTES)	-	-
EXCESSIVE ALGAL GROWTH	-	-
TOTAL TOXICS	-	-
TURBIDITY	2.70	22.55
EXOTIC SPECIES	-	-
OTHER	-	-

* Category not applicable.
- Category applicable, no data available.
0 Category applicable, size of waters is zero.

The relative magnitude of causes does not necessarily correspond to degree of use support. For example, a waterbody could have three causes labeled as moderate, but be sufficiently impaired from these multiple causes such that it is assessed as not supporting.

Most of the causes in the above table are self-explanatory, but the following warrant clarification.

Siltation - refers to the deposition of sediment on the bottom of a waterbody causing such impacts as the smothering of benthic habitats in streams or the filling in of lakes.

Thermal Modification - usually involves the heating of the receiving waters by a point source (e.g. plant cooling water) or nonpoint sources (e.g. runoff from pavement or elimination of bank shading).

Flow Alteration - refers to frequent changes in flow or chronic reductions in flow that impact aquatic life (e.g. as flow regulated rivers or a stream with extensive irrigation withdrawls).

Other Habitat Alterations - may include removal of woody debris or cobbles from a stream.

Exotic Species - introduced plants and animals that can interfere with natural fisheries, endangered species or other components of the ecosystem.

This table was generated from the waterbody-specific information in WBS.

RELATIVE ASSESSMENT OF SOURCES

Sources are the facilities or activities that contribute pollutants or stressors, resulting in impairment of designated uses in a waterbody. The total size (in square miles) of estuaries affected by each category of source is provided in the following table, including the size with overall point and nonpoint source impacts. A waterbody which is affected by several sources of pollution has the appropriate size counted in each relevant source category. If the relative contribution of the source is listed in the waterbody-specific information as "High", the size with less than full support should be included as a major contribution. If it is listed as "Moderate" or "Slight", the size should be included as a "Moderate/Minor" contribution.

The following table contains the full list of source categories as stored in WBS. It is provided to increase the overall usefulness of this report and the WBS database. All of the data is reported verbatim as generated by the WBS report generating program.

TABLE 4-5B: TOTAL SIZES OF WATERS IMPAIRED BY VARIOUS SOURCE CATEGORIES

Type of Waterbody: Estuaries (Reported in Square Miles)

SOURCE CATEGORY	CONTRIBUTION TO IMPAIRMENT	
	MAJOR	MODERATE/MINOR
INDUSTRIAL POINT SOURCES	0.00	0.56
MUNICIPAL POINT SOURCES	-	-
COMBINED SEWER OVERFLOW	-	-
COLLECTION SYSTEM FAILURE	-	-
DOMESTIC WASTEWATER LAGOON	-	-
AGRICULTURE	0.00	12.03
CROP RELATED SOURCES	-	-
GRAZING RELATED SOURCES	-	-
INTENSIVE ANIMAL FEEDING OPERATIONS	-	-
SILVICULTURE	-	-
CONSTRUCTION	0.00	10.33
URBAN RUNOFF/STORM SEWERS	0.20	28.26
RESOURCE EXTRACTION	-	-
LAND DISPOSAL	-	-
HYDROMODIFICATION	-	-
HABITAT MODIFICATION (NON HYDDROMODIFICATION)	-	-
MARINAS AND RECREATIONAL BOATING	0.00	0.83
EROSION FROM DERELICT LAND	-	-
ATMOSPHERIC DEPOSITION	-	-
WASTE STORAGE/STORAGE TANK LEAKS	-	-
LEAKING UNDERGROUND STORAGE TANKS	-	-
HIGHWAY MAINTENANCE AND RUNOFF	-	-
SPILLS	-	-
CONTAMINATED SEDIMENTS[c]	-	-
DEBRIS AND BOTTOM DEPOSITS	-	-
INTERNAL NUTRIENT CYCLING (LAKES)	-	-
SEDIMENT RESUSPENSION	-	-
NATURAL SOURCES	2.20	30.71
RECREATIONAL AND TOURISM ACTIVITIES	-	-
SALT STORAGE SITES	-	-
GROUNDWATER LOADINGS	-	-
GROUNDWATER WITHDRAWAL	-	-

SOURCE CATEGORY	CONTRIBUTION TO IMPAIRMENT	
	MAJOR	MODERATE/MINOR
OTHER	-	-
UNKNOWN SOURCE	0.00	5.10
SOURCES OUTSIDE STATE JURISDICTION/BORDERS	-	-

* Category not applicable.
- Category applicable, no data available.
0 Category applicable, size of waters is zero.

The information used to generate the above table is from the Source Size and Source Magnitude fields of the WBS database.

The causes and sources in the WBS were linked as much as possible utilizing the special link field provided for this purpose.

COASTAL SHORELINES

TABLE 4-2C: SUMMARY OF FULLY SUPPORTING, THREATENED AND IMPAIRED WATERS

Type of Waterbody: Coastal Shoreline (Reported in Miles)

DEGREE OF USE SUPPORT	ASSESSMENT CATEGORY		TOTAL ASSESSED SIZE
	EVALUATED	MONITORED	
SIZE FULLY SUPPORTING ALL *ASSESSED* USES	644.99	137.08	782.07
SIZE FULLY SUPPORTING ALL *ASSESSED* USES, BUT THREATENED[a] FOR AT LEAST ONE USE	6.20	4.25	10.45
SIZE IMPAIRED[b] FOR ONE OR MORE USES	6.50	84.82	91.32
SIZE NOT ATTAINABLE FOR ANY USE AND NOT INCLUDED IN THE LINE ITEMS ABOVE	0.00	0.50	0.50
TOTAL ASSESSED	657.69	226.65	884.34

[a] Size threatened is a distinct category of waters and is NOT a subset of the size fully supporting uses. It is added into the totals in the bottom line.
[b] Impaired means partially or not supporting a designated use.

TABLE 4-3C: INDIVIDUAL USE SUPPORT SUMMARY

Type of Waterbody: Coastal Shoreline (Reported in Miles)

GOALS	USE	SIZE ASSESSED	SIZE FULLY SUPPORTING	SIZE SUPPORTING, BUT THREAT-ENED	SIZE PARTIALLY SUPPORTING	SIZE NOT SUPPORTING	SIZE NOT ATTAINABLE	SIZE NOT ASSESSED
	OVERALL	884.34	782.07	10.45	64.05	27.27	0.50	0.00
PROTECT & ENHANCE ECOSYSTEM	AQUATIC LIFE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PROTECT & ENHANCE PUBLIC HEALTH	FISH CONSUMPTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SHELLFISHING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SWIMMING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SECONDARY CONTACT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DRINKING WATER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOCIAL & ECONOMIC	NON-DEGREDATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	AESTHETICS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	AGRICULTURE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	CULTURAL OR CEREMONIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00

* Category not applicable.
\- Category applicable, no data available.
0 Category applicable, size of waters is zero.

The individual use support summary table lists the specific designated uses and combines Clean Water Act reporting and designated use reporting. The fishable goal of the Clean Water Act is reported under the Fish Consumption, Shellfishing, and Aquatic Life Support Uses, and the swimmable goal is reported under the Swimming and Secondary Contact Uses. The WBS was used to generate this table.

CAUSES/STRESSORS AND SOURCES OF NONSUPPORT OF DESIGNATED USES

For those waters which were assessed and were not fully supporting their designated uses (i.e. partially and not supporting uses), the following information is being provided to illustrate the causes and sources of use impairment statewide.

RELATIVE ASSESSMENT OF CAUSES/STRESSORS

Causes are those pollutants or other stressors that contribute to the actual or threatened impairment of designated uses in a waterbody. Stressors are factors or conditions (other than specific pollutants) that cause impairment (e.g. flow and other habitat alterations, presence of exotic species). The following table provides the total size (in miles) of coastal shoreline affected by each cause category. A waterbody which is affected by several different causes will have its size counted separately in each relevant cause category. If the relative contribution of the cause is listed in the waterbody-specific information as "High", the size of the waterbody with less than full support is included in the "Major Contribution" column. If the contribution is listed as "Moderate" or "Slight", the size is included in the "Moderate/Slight Contribution" column. (Note that WBS uses the terms "High", "Moderate" and "Slight" rather than "Major", "Moderate" and "Minor".)

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TABLE 4-4C: TOTAL SIZES OF WATERS IMPAIRED BY VARIOUS CAUSE/STRESSOR CATEGORIES

Type of Waterbody: Coastal Shoreline (Reported in Miles)

CAUSE/STRESSOR CATEGORY	SIZE OF WATERS BY CONTRIBUTION TO IMPAIRMENT	
	MAJOR	MODERATE/MINOR
CAUSE/STRESSOR UNKNOWN	0.00	2.30
UNKNOWN TOXICITY	-	-
PESTICIDES	-	-
PRIORITY ORGANICS	-	-
NONPRIORITY ORGANICS	-	-
PCBs	-	-
DIOXINS	-	-
METALS	0.00	2.10
AMMONIA	0.00	4.00

CAUSE/STRESSOR CATEGORY	SIZE OF WATERS BY CONTRIBUTION TO IMPAIRMENT	
	MAJOR	MODERATE/MINOR
CYANIDE	-	-
SULFATES	-	-
CHLORINE	-	-
OTHER INORGANICS	-	-
NUTRIENTS	17.74	123.37
pH	-	-
SILTATION	0.00	104.45
ORGANIC ENRICHMENT/LOW DO	0.00	2.20
SALINITY/TDS/CHLORIDES	-	-
THERMAL MODIFICATIONS	-	-
FLOW ALTERATIONS	-	-
OTHER HABITAT ALTERATIONS	-	-
PATHOGEN INDICATORS	1.90	55.68
RADIATION	-	-
OIL AND GREASE	0.00	2.00
TASTE AND ODOR	-	-
SUSPENDED SOLIDS	0.00	108.15
NOXIOUS AQUATIC PLANTS (MACROPHYTES)	-	-
EXCESSIVE ALGAL GROWTH	-	-
TOTAL TOXICS	-	-
TURBIDITY	13.70	107.06
EXOTIC SPECIES	-	-
OTHER	-	-

* Category not applicable.
\- Category applicable, no data available.
0 Category applicable, size of waters is zero.

The relative magnitude of causes does not necessarily correspond to degree of use support. For example, a waterbody could have three causes labeled as moderate, but be sufficiently impaired from these multiple causes such that it is assessed as not supporting.

Most of the causes in the above table are self-explanatory, but the following warrant clarification.

Siltation - refers to the deposition of sediment on the bottom of a waterbody causing such impacts as the smothering of benthic habitats in streams or the filling in of lakes.

Thermal Modification - usually involves the heating of the receiving waters by a point source (e.g. plant cooling water) or nonpoint sources (e.g. runoff from pavement or elimination of bank shading).

Flow Alteration - refers to frequent changes in flow or chronic reductions in flow that impact aquatic life (e.g. as flow regulated rivers or a stream with extensive irrigation withdrawls).

Other Habitat Alterations - may include removal of woody debris or cobbles from a stream.

Exotic Species - introduced plants and animals that can interfere with natural fisheries, endangered species or other components of the ecosystem.

This table was generated from the waterbody-specific information in WBS.

RELATIVE ASSESSMENT OF SOURCES

Sources are the facilities or activities that contribute pollutants or stressors, resulting in impairment of designated uses in a waterbody. The total size (in miles) of coastal shoreline affected by each category of source is provided in the following table, including the size with overall point and nonpoint source impacts. A waterbody which is affected by several sources of pollution has the appropriate size counted in each relevant source category. If the relative contribution of the source is listed in the waterbody-specific information as "High", the size with less than full support should be included as a major contribution. If it is listed as "Moderate" or "Slight", the size should be included as a "Moderate/Minor" contribution.

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All of the data is reported verbatim as generated by the WBS report generating program.

TABLE 4-5C: TOTAL SIZES OF WATERS IMPAIRED BY VARIOUS SOURCE CATEGORIES

Type of Waterbody: Coastal Shoreline (Reported in Miles)

SOURCE CATEGORY	CONTRIBUTION TO IMPAIRMENT	
	MAJOR	MODERATE/MINOR
INDUSTRIAL POINT SOURCES	0.00	0.50
MUNICIPAL POINT SOURCES	-	-
COMBINED SEWER OVERFLOW	-	-
COLLECTION SYSTEM FAILURE	-	-
DOMESTIC WASTEWATER LAGOON	-	-
AGRICULTURE	0.00	19.10
CROP RELATED SOURCES	-	-
GRAZING RELATED SOURCES	-	-
INTENSIVE ANIMAL FEEDING OPERATIONS	-	-
SILVICULTURE	-	-
CONSTRUCTION	0.00	5.50
URBAN RUNOFF/STORM SEWERS	4.90	50.73
RESOURCE EXTRACTION	-	-
LAND DISPOSAL	-	-
HYDROMODIFICATION	-	-
HABITAT MODIFICATION (NON HYDDROMODIFICATION)	-	-
MARINAS AND RECREATIONAL BOATING	0.00	2.50
EROSION FROM DERELICT LAND	-	-
ATMOSPHERIC DEPOSITION	-	-
WASTE STORAGE/STORAGE TANK LEAKS	-	-
LEAKING UNDERGROUND STORAGE TANKS	-	-
HIGHWAY MAINTENANCE AND RUNOFF	-	-
SPILLS	-	-
CONTAMINATED SEDIMENTS[c]	-	-
DEBRIS AND BOTTOM DEPOSITS	-	-
INTERNAL NUTRIENT CYCLING (LAKES)	-	-
SEDIMENT RESUSPENSION	-	-
NATURAL SOURCES	3.00	95.15

SOURCE CATEGORY	CONTRIBUTION TO IMPAIRMENT	
	MAJOR	MODERATE/MINOR
RECREATIONAL AND TOURISM ACTIVITIES	-	-
SALT STORAGE SITES	-	-
GROUNDWATER LOADINGS	-	-
GROUNDWATER WITHDRAWAL	-	-
OTHER	-	-
UNKNOWN SOURCE	0.30	2.25
SOURCES OUTSIDE STATE JURISDICTION/BORDERS	-	-

* Category not applicable.
- Category applicable, no data available.
0 Category applicable, size of waters is zero.

The information used to generate the above table is from the Source Size and Source Magnitude fields of the WBS database.

The causes and sources in the WBS were linked as much as possible utilizing the special link field provided for this purpose.

SPECIAL TOPICS

CASE STUDIES

ALA WAI WATERSHED
See Appendix A for a study on the Ala Wai Watershed.

WEST MAUI WATERSHED
See Appendix J for a study on the West Maui Watershed.

INFORMATION ON EUTROPHICATION

HYPOXIA and ANOXIA
There were no reported incidents of hypoxia or anoxia during the reporting period.

ALGAL BLOOMS
There were no reported incidents of significant algal blooms during the reporting period.

NUTRIENT LOADINGS

Hawaii does not have combined sewers. Therefore, there are no estimates for nutrient loadings for these types of sewers.

Nutrient loading estimates are available for the six Water Quality Limited Sections for which TMDL's were completed. The TMDL report was produced by William Freeman of Pacific Environmental Research through a contract with the DOH Environmental Planning Office in November of 1993. While the report does estimate the amount of nutrient loading for the six Water Quality Limited Segments, there are also no NPDES permitted point source dischargers for nutrients (nitrogen and phosphorus) in these waters. Hence, the best estimates are strictly for non-point sources only. The following are the six Water Quality Limited Segments and their respective estimated total non-point source nutrient loadings.

Ala Wai Canal

Total NPS Nitrogen (mean) - 1.47×10^4 kg/yr
Total NPS Phosphorus (mean) - 6.93×10^3 kg/yr

Kewalo Basin

Total NPS Nitrogen (mean) - 5.58×10^2 kg/yr
Total NPS Phosphorus (mean) - 3.77×10^2 kg/yr

Honolulu Harbor

Total NPS Nitrogen (mean) - 1.14×10^4 kg/yr
Total NPS Phosphorus (mean) - 2.08×10^3 kg/yr

Keehi Lagoon

Total NPS Nitrogen (mean) - 2.34×10^4 kg/yr
Total NPS Phosphorus (mean) - 4.79×10^3 kg/yr

Pearl Harbor

Total NPS Nitrogen (mean) - 2.05×10^5 kg/yr
Total NPS Phosphorus (mean) - 3.95×10^4 kg/yr

Kaneohe Bay

Total NPS Nitrogen (mean) - 5.22×10^4 kg/yr
Total NPS Phosphorus (mean) - 1.03×10^4 kg/yr

There is no other nutrient loading information available for any of the other waterbodies. The Environmental Planning Office is currently investigating methods to determine TMDL's for all of the Water Quality Limited Segments.

PROJECTED LAND USE CHANGES

No major changes are anticipated in land usage.

HABITAT MODIFICATION

State marine waters are broken up into two categories, Class AA and Class A. Class AA waters are intended to remain in their natural pristine state as nearly as possible with an absolute minimum of pollution or alteration of water quality from any human-caused source or actions. Hence, no habitat modifications are allowed in these areas. Class A waters may be used for recreation, aesthetic enjoyment, and other uses provided it is compatible with the protection and propagation of fish, shellfish and wildlife, and with recreation in and on these waters. Therefore, all activities in Class A waters must have minimal impacts on habitat modification and any human-related alterations must be pre-approved through the permitting process.

There is very little information available concerning the status and trends in acreage of submerged aquatic vegetation. The only data regularly collected is that required by discharge permits. Pre-construction survey projects may also have limited data for the construction area.

As previously discussed in the section on wetlands, there is currently no information available concerning the acreage of tidal wetlands. The US Fish and Wildlife Service has not conducted an inventory of wetlands for Hawaii and no such inventory is planned for the future.

No information is available concerning the miles of diked, bulkheaded or stabilized shoreline. It should be noted that such activities are considered illegal.

No information is available concerning dredging operations.

CHANGES IN LIVING RESOURCES

As stated above, information concerning aquatic habitats is nearly non-existent. Without this type of information, it becomes difficult, if not impossible, to evaluate the changes in living resources. While some statistical information regarding harvests do exist, these too are limited and cannot provide an accurate picture of the increases or decreases in the abundance or distribution of species dependent on estuarine or near coastal waters.

Also, no assessments of the changes in species diversity over time can be made.

The following table contains the commercial fish catch totals for the State of Hawaii. The figures represent the total catches of all licensed commercial fishers. It includes both sea and pond catches, but excludes coral harvests. Note that the figures for 1979 through 1988 may be incomplete due to unreported aku (skipjack tuna) and longline boat catches. The information is from the State Data Book. These totals are for the fiscal years ending in June of each year. Data is only available up to 1994.

YEAR	POUNDS LANDED
1970	9,786,726
1971	15,176,525
1972	15,577,669
1973	14,029,491
1974	13,997,774
1975	10,801,441
1976	11,893,141
1977	15,298,515
1978	13,672,061
1979	12,310,524
1980	10,418,964
1981	10,890,468
1982	9,178,789
1983	7,841,959
1984	9,819,800
1985	9,436,591

YEAR	POUNDS LANDED
1986	9,503,193
1987	12,128,527
1988	11,052,502
1989	13,493,866
1990	14,008,279
1991	16,663,945
1992	23,578,601
1993	25,209,513
1994	24,028,693

The steady increase in the fish catch is probably due to an increase in the number of commercial fishermen. No other information concerning the increase in the catch is available.

TOXIC CONTAMINATION

In general, Hawaii is relatively free from toxic contamination. The largest problem involving a toxic substance is the elevated arsenic levels which resulted from a now defunct canec plant in Hilo. This problem is discussed in detail below in the sediment contamination section.

There were no incidents of toxics in fish or shellfish. (Keep in mind that DOH suspended all toxics monitoring due to budgetary constraints.) Previous toxics samplings did not identify elevated levels of toxins which required the issuance of warnings or consumption restrictions.

There were no cases of fish kills or fish abnormalities associated with toxics.

PATHOGEN CONTAMINATION

Pathogen contamination is normally identified indirectly through the use of an indicator organism. In the past, *Fecal Coliform* was used as the indicator, and it is still used as the indicator for fresh waters. *Enterococcus* is the currently accepted indicator organism for marine waters. *Enterococcus* was found to correlate fairly well with incidents of gastrointestinal illnesses for personnel exposed to sewage contaminated marine waters. Unfortunately,

sewage is not the only source of *Enterococcus* in the environment. Soils have been found to contain this bacteria in concentrations in the hundreds of thousands of colonies per 100 ml. Birds and animals also contribute to the ambient levels. While some of these bacteria do not survive in the environment, much of them do and eventually find their way into streams and ultimately the coastal waters. Samples of the coastal waters taken during or immediately after rain runoff has washed the bacteria into the ocean will show elevated *Enterococcus* levels despite the total absence of sewage. As a result, care must be taken to ensure that DOH does not unnecessarily alarm the public when non-sewage related, elevated *Enterococcus* levels are present. DOH is currently in the process of incorporating an additional indicator organism, *Clostridia Perfringens*, into the Water Quality Standards to further enhance the reliability of *Enterococcus* as the primary indicator organism.

In general, contamination with *Enterococcus* is greatest in those areas which are influenced by stormwater and stream runoff. Hence, streams can be expected to have the highest levels of contamination, followed by estuaries and coastal areas. As discussed above, this contamination is mainly due to nonpoint sources and only rarely is the source identified as being from sewage. The waterbody evaluations did not make a distinction between these two sources and therefore many sections are described as partially or not fully supporting uses based on high indicator organism levels without regard to the source. If the intent is to truly identify health risks, then either the source must be considered along with the elevated levels or another indicator(s) must be found which will correctly reflect the potential for illness.

The network of coastal and estuary monitoring stations have shown that sites with elevated *Enterococcus* levels do exist, however, none have been associated with the discharge of sewage. In contrast, correlation with rainfall has been demonstrated. Therefore, despite the elevated *Enterococcus* levels, it is reasonable to assume that there are no areas accessible to the public which are compromised by pathogen contamination such that contact

with these waters would significantly increase the risk of illness.

This would not be the case should elevated levels of *Enterococcus* bacteria be due to a sewage spill. In this situation, the original assumptions applicable to the high counts would allow for a potential increase in the risk of illnesses should contact occur.

During this reporting cycle there were no beach closures.

Pathogen contamination of shellfish can also occur, however, there were no incidents reported.

AREAS FOR WHICH NO DATA ARE CURRENTLY AVAILABLE

Much of the coastal waterbodies in the State of Hawaii are covered by the routine monitoring station network. The network also includes a limited number of stations in estuaries and streams, however, the intent of these stations is to monitor the impact of the streams on coastal waters. Thus, few estuaries are monitored regularly. Note that by definition, estuaries exist at the mouths of nearly all of the streams in the state.

Conversely, although many streams and estuaries remain unmonitored, the vast majority are not directly influenced by human-related or human-caused pollution. Nonpoint source pollutants cause the largest impacts. Hence, while data for these areas may not be available, similarities with other streams and estuaries will allow the establishment of general conclusions.

DATA COLLECTION METHODS AND LIMITATIONS

The data in this chapter was obtained mainly from the Clean Water Branch's water quality monitoring program. CWB personnel conducted the sampling, processed the data, stored the data in STORET, conducted the waterbody evaluations for WBS, established the WBS database, and retrieved all necessary reports for the 305 (b) report. Weaknesses in the data are mostly due to the weaknesses inherent in the water quality monitoring program itself, rather than in the data collection methods.